

**GROUND WATER MANAGEMENT PLAN**  
for  
**MADERA WATER DISTRICT**

December 1, 1997

Prepared by

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## **I. INTRODUCTION**

### **A. General**

The Madera Water District was formed in 1987 under the California Government Code. The District covers approximately 3,740 acres wholly within Madera County about three miles northeast of the City of Madera (Figures 1 and 2).

On July 9, 1997 the District's board of directors adopted a resolution of intention to draft a Ground Water Management Plan, pursuant to California Assembly Bill No. 3030 (AB 3030). A copy of Madera Water District Resolution No. 97-1 is included as Appendix A.

### **B. Purpose and Goal**

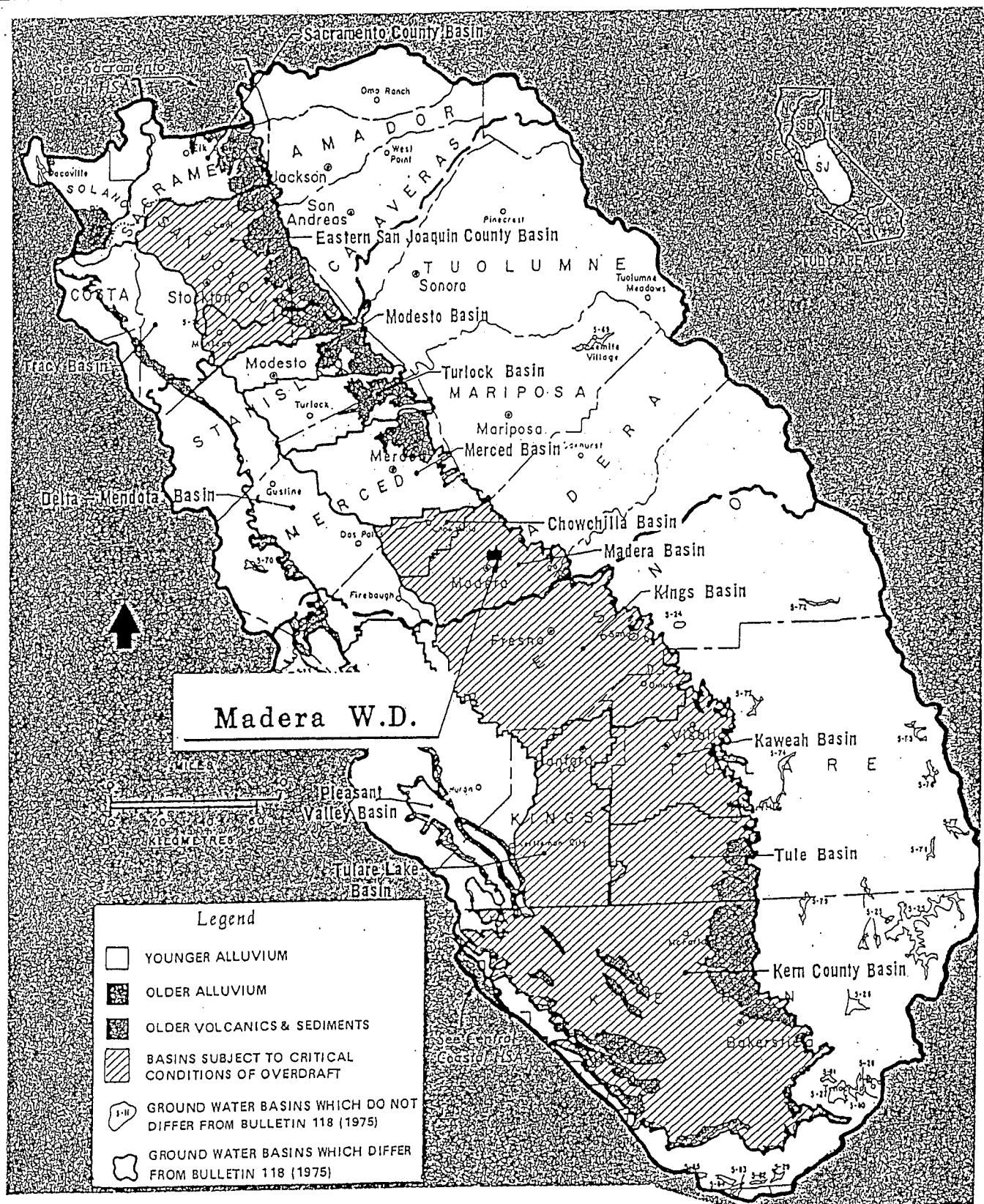
The purpose of this Ground Water Management Plan is to develop a coordinated and comprehensive approach to the evaluation and management of ground water resources within the Madera W.D.

The goal of this Plan is to implement effective ground water management which moves to restore, where possible, and maintain a high quality and dependable ground water resource.

Upon adoption of this Plan, action on specific elements will be initiated within the Management Program to achieve the stated goal. As specific elements take effect, and/or other concerns arise, the Management Program may be revised to assure continued progress toward the management goal.

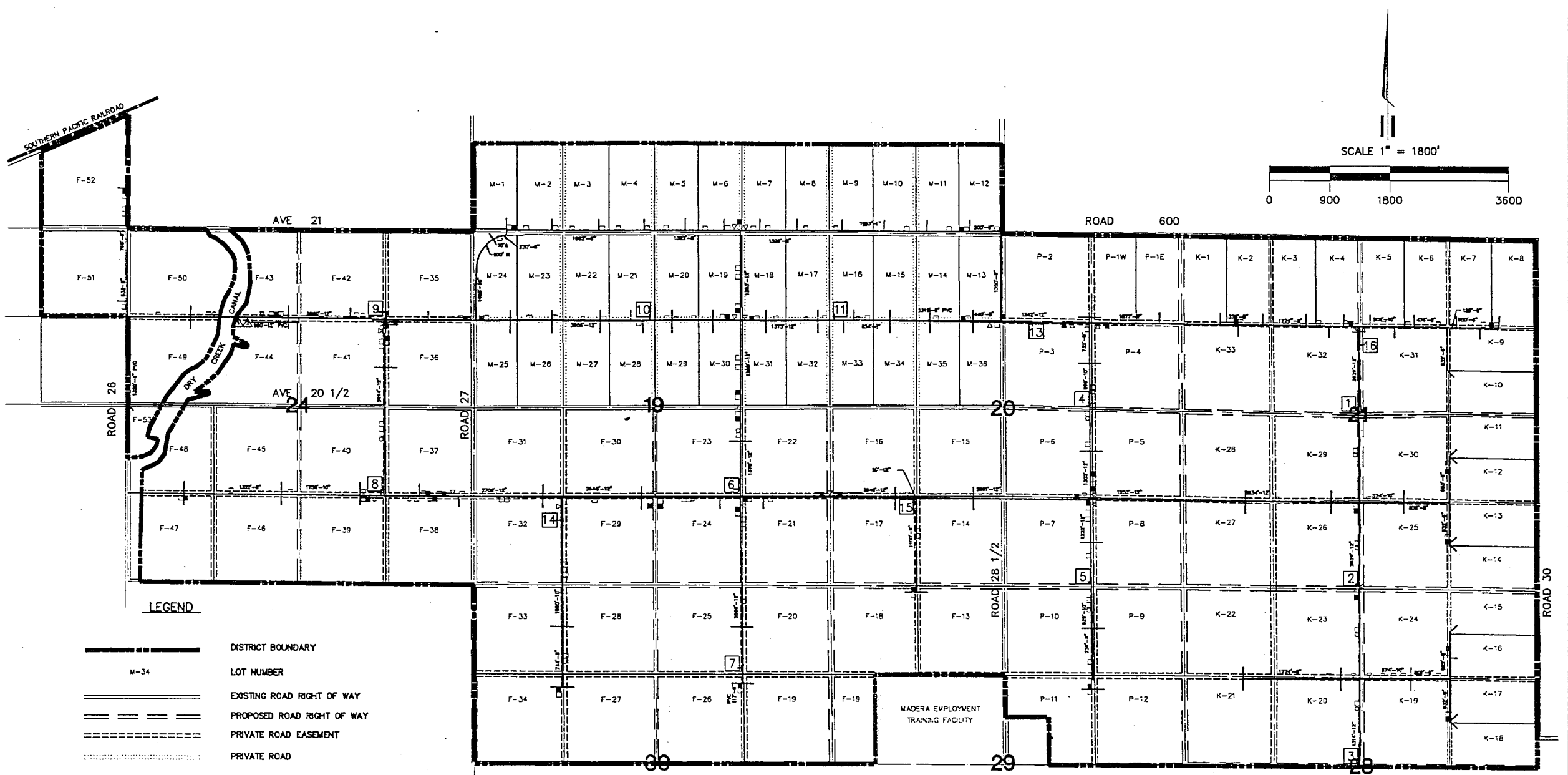
### **C. Authority**

California Assembly Bill No. 3030, which became law on January 1, 1993, authorized local agencies that are within ground water basins as defined in California Department of Water Resources (DWR) Bulletin 118-80, and that meet certain other criteria, to prepare and adopt ground water management plans. Madera Water District qualifies under the law. The District encompasses a portion of the Madera Ground Water Basin as defined in Bulletin 118-80, which lies within the San Joaquin Basin Hydrologic Study Area (Figure 1).



San Joaquin Basin Hydrologic Study Area

Madera Water District  
Ground Water Management Plan  
**FIGURE 1** LOCATION MAP



**LEGEND**

- DISTRICT BOUNDARY
- LOT NUMBER
- EXISTING ROAD RIGHT OF WAY
- PROPOSED ROAD RIGHT OF WAY
- PRIVATE ROAD EASEMENT
- PRIVATE ROAD
- PRESSURE RELEASE VALVE
- WATERMAN AIR RELEASE VALVE
- APCO AIR RELEASE VALVE
- GATE

NOTE: ALL MAIN LINES ARE ASBESTOS CEMENT UNLESS OTHERWISE NOTED.

8

WELL SITE

1

DRY CREEK PUMP SITE

SERVICE (40 Ac. -4", 20 Ac. 3")

<b>PROVOST &amp; PRITCHARD</b> CIVIL ENGINEERS 1000 N. 1ST STREET, SUITE 100 MADERA, CALIF. 93650 TEL: (559) 691-1111 FAX: (559) 691-1112	<b>MADERA WATER DISTRICT</b>		SCALE 1" = 1800'
	<b>WATER DISTRIBUTION SYSTEM</b>		DATE JUN 95
	DESIGNED BY JUN 95	CHECKED BY JUN 95	APPROVED BY JUN 95
	JOB NO. 8531300 SHEET NO. 01-0771		

## II. DESCRIPTION OF DISTRICT

### A. Description of District Area

#### 1) Location

The Madera Water District is situated on the eastern edge of the San Joaquin Valley of California approximately five miles north of downtown Madera, in Madera County (Figure 1).

#### 2) Topography

Land in the District generally slopes downward to the west at around 15 feet per mile. However, some slopes are steeper where the land is cut by small local drainages. Elevations range from about 350 feet above mean sea-level on the east side of the District, to around 280 feet on the west.

#### 3) Climate

The climate of Madera W.D. is characterized by cool, mild winters and hot, dry summers. Temperatures in the summer often exceed 100 degrees Fahrenheit. Fog may be experienced for long periods in the winter, with daily low temperatures typically in the mid-30's. Winter temperatures occasionally drop into the 20's. Average annual precipitation is about 10 inches, with 80 percent of the rainfall occurring in the winter months. The frost-free growing season averages around 250 days per year.

### B. Water Supply

#### 1) Surface Water Quantity

Madera Water District does not have a surface water supply. Approximately 2,183 net acres were subordinately annexed into Madera Irrigation District in July 1991. This land does not have a normal water allocation from Madera Irrigation District. However, the District can purchase surface water for this land from Madera Irrigation District when sufficient water is available. This water is delivered via the Dry Creek Canal. The District recently installed a new pumping plant on Dry Creek Canal, in addition to an existing pumping plant, to use more surface water when it is available. This surface water is used to supplement ground water in meeting the crop water requirements. The District will purchase as much surface water each year as economically possible to conserve



groundwater, even though the cost of this water can increase substantially during drought periods.

2) **Surface Water Quality**

The Friant water from Madera I.D. that may be diverted into the District is of excellent quality for irrigation purposes.

3) **Ground Water Quantity**

The District lies on the eastern fringe of the enormous San Joaquin Valley-wide aquifer. Madera W.D. owns and operates wells to meet District water demands. Ground water supplies have been adequate to meet crop requirements, even after extended drought.

4) **Ground Water Quality**

Ground water quality in the District is generally adequate for agricultural use. Sufficient data is not available to characterize ground water quality in Madera W.D. in any greater detail.

C. **Land Use**

Madera Water District was formed in 1987, at which time agricultural development of the District was complete. The entire District is planted to mature pistachio orchard.

D. **Water Demand**

Water demand within the Madera W.D. is fairly stable from year to year as the entire District is planted to mature pistachio orchards. The District schedules and delivers water to each individual orchard on a rotation basis as dictated by climatic conditions and water user requests. Each of the District wells and surface water pumping plants are metered and the District maintains records of metered water use. Water use for the past five years is shown below:

WATER DEMAND (acre-feet)

	<u>Surface Water</u>	<u>Groundwater</u>	<u>Total Use</u>
1993	<u>1.095</u>	<u>7.585</u>	<u>8.680</u>
1994	<u>850</u>	<u>9.115</u>	<u>9.965</u>
1995	<u>1.404</u>	<u>6.913</u>	<u>8.317</u>
1996	<u>1.660</u>	<u>7.047</u>	<u>8.707</u>
1997	<u>3.451</u>	<u>6.633</u>	<u>10.084</u>

The amount of surface water used in 1997 has increased, and ground water use decreased, as a result of improvements made to the District distribution system as discussed later in this report.

**E. Water Related Facilities**

**1) District System Inventory**

The District owns and maintains an extensive underground piped distribution system that delivers water under pressure to each field. There are no District owned canals. The distribution system is a looping, closed system, with the surface water pumping plants and the groundwater wells pumping directly into the pipeline. The District owns 16 groundwater wells and three surface water pumps. The majority of lands within the District use micro-irrigation systems to apply the water, and the remaining lands use hose-pull sprinkler systems. The District system is operated to maintain a minimum pressure of 30 psi at field turnouts, which is adequate to run the irrigation systems without the landowner having to use in-field booster pumps.

In 1996-97, the District significantly increased the flexibility of the distribution system by installing a surface water pump station and 4-1/2 mile conveyance pipeline. This allows additional surface water to be used within the District when available, to supplement the District wells and provide much needed additional capacity and better pressure distribution within the system.

2) **Other Facilities**

There are no other agriculture related water facilities within Madera Water District.

F. **Institutional Programs**

1) **Ground Water Monitoring Programs**

**Well Water Levels**

The United States Bureau of Reclamation (USBR) and the California Department of Water Resources (DWR) act as clearing houses to gather and process well water-level data from agencies and organizations throughout the San Joaquin Basin Hydrological Study Area. Madera W.D. does not currently participate in this program, however, DWR does monitor water levels in some wells in the vicinity of the District.

**Well Water Quality**

No program currently exists to systematically collect and evaluate ground water quality data within Madera W.D.

### III. HYDROGEOLOGIC CHARACTERISTICS

#### A. Ground Water Basin Description - Madera Basin

The Madera Basin has been identified by the DWR as a basin with boundaries appropriate for ground water management purposes (DWR Bulletin 118-80). These boundaries were identified on the basis of geological and hydrological conditions, as well as political boundary lines. The Madera Basin lies within the San Joaquin Basin Hydrologic Study Area (HSA). Madera W.D. lies in the eastern portion of the Madera Basin (Figure 1). The individual basins within the San Joaquin Basin HSA were defined primarily upon political boundaries due to the continuous aquifer system within the HSA.

The Madera Basin was determined in Bulletin 118-80 to be a "critically overdrafted" basin, according to the following definition:

"A basin is subject to critical conditions of overdraft when continuation of present water management practices would probably result in significant adverse overdraft-related environmental, social or economic impacts."

This definition implies a more dire circumstance than mere "ground water overdraft", which is generally defined as that condition where extractions exceed ground water replenishment over some specified time period.

The Madera Basin extends from the Sierra Nevada foothills on the east to the eastern boundary of the Columbia Canal Company Service Area on the west, and from the San Joaquin River on the south to the southern boundary of the Chowchilla Groundwater Basin on the north.

#### B. Madera Water District - Aquifer Characteristics

##### 1) Geology

**Overview** - The Madera Water District overlies a portion of a continuous aquifer system that occupies the central valley of California. The District lies within a sub-basin designated by the DWR as the Madera Groundwater Basin, within the San Joaquin Basin Hydrologic Study Area. The aquifer below the Madera Water District extends to depths ranging to greater than 2,000 feet before basement rock is encountered, but the practical limit of the aquifer is typically considered to be at the base of the fresh water (defined as water containing less than 2,000 parts per million dissolved solids). This zone of fresh water may extend to the basement rock beneath

the District. Data is sparse on the periphery of the valley, and the hydrogeologic boundaries in the vicinity of the District are imprecise.

The Madera Water District does not overlie any of the major confining clay layers that have been identified in the valley. However, the deposits underlying the District are composed of older alluvium and continental deposits that are liable to include interfingered layers of relatively impermeable materials.

**Soils** - Surface soils in the District are predominantly loams, ranging from sandy loams to clays. In much of the District hardpan occurs at or close to the surface. Soils within the region were deposited on the San Joaquin River alluvial fan during flood periods and are derived from mixed granitic and sedimentary rocks from the Sierra Nevada mountains. The soils are considered part of the "older alluvium", not having received fresh deposits recently, and often have large amounts of clay in the subsurface. Soils throughout the region are stratified, with interspersed sandy and clayey layers.

## 2) Well Yields

Well yields within Madera W.D. range from 500 to 1,500 gallons per minute. The average well yield in the District is around 900 gpm.

## 3) Storage Capacity

The aquifer currently being used by agricultural wells within the District is approximately 600 feet deep. Assuming it is desirable for the water table to come no closer than ten feet from the ground surface, and applying an average specific yield of 0.075 to the aquifer, total storage capacity of the aquifer in use can be estimated to be 165,000 af. Specific yield is the ratio of the volume of water which will drain freely from a material to the total volume of the formation.

## **IV. GROUND WATER CONDITIONS**

### **A. Historical Conditions**

#### **1) Ground Water Levels**

Prior to development of ground water resources in the Madera W.D. area, ground water was typically around 60 feet below the ground surface, and the direction of ground water flow was to the southwest. In the fall of 1936, the first period for which a ground water map is available, well water-level elevation averaged around 260 feet above mean sea-level in the District (Figure 3).

As development began in the region, ground water levels started to decline. By the spring of 1965, District ground water elevation ranged from around 220 to 260 feet above m.s.l. (Figure 4). The direction of flow remained to the southwest.

Since 1965 the direction of ground water flow has shifted towards due west, and levels have continued to decline. In the spring of 1993 ground water elevation appears to have averaged about 150 feet above m.s.l. (Figure 5). Madera W.D. has always been on the edge of the region covered by the DWR in their ground water maps, but since 1985 the DWR maps have provided little or no coverage of the District area.

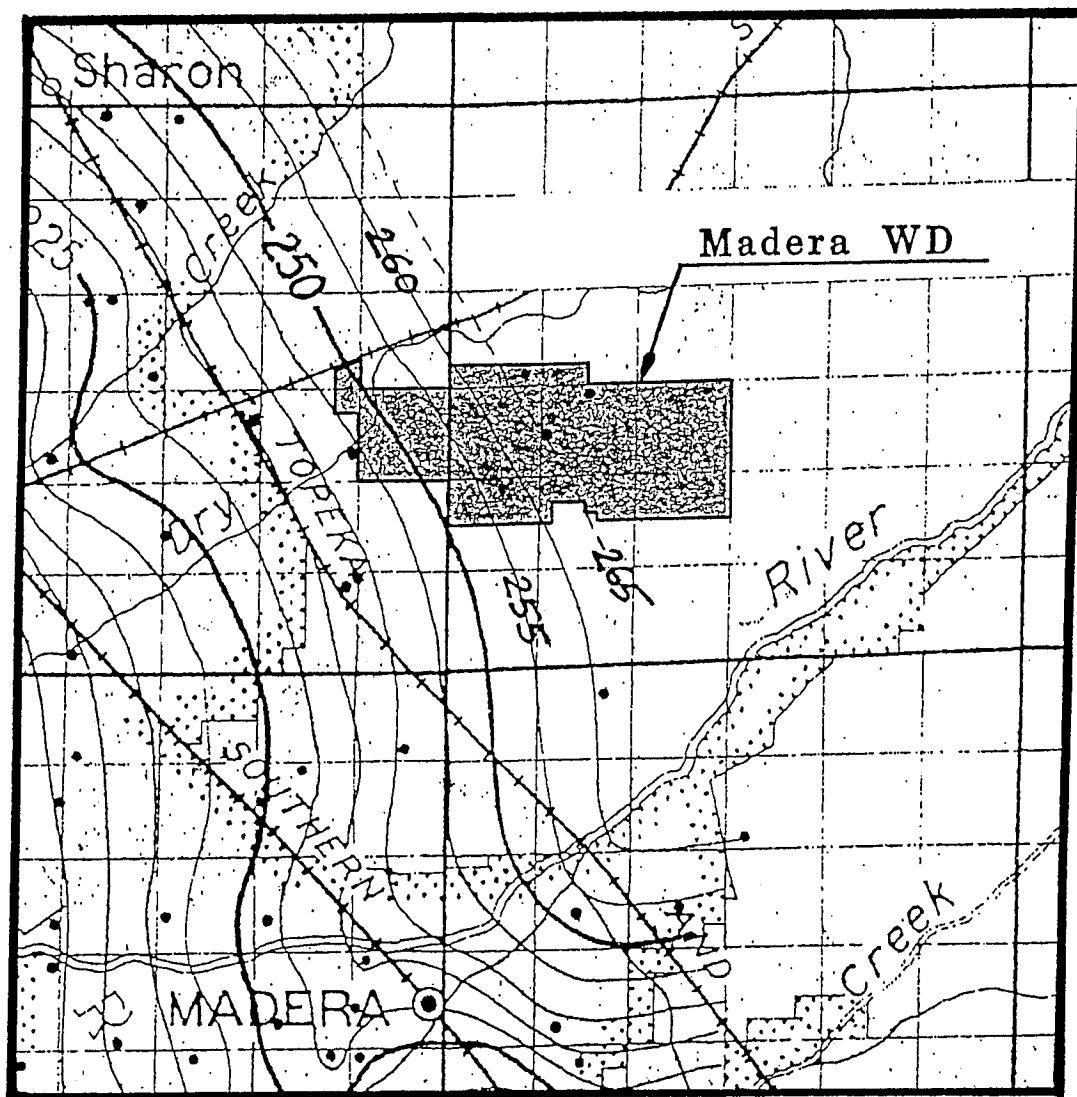
#### **2) Ground Water Quality**

Ground water quality data for the District area is not readily available. As stated previously, in Chapter 2, the ground water has been of adequate quality for agricultural use.

### **B. Current Conditions**

#### **1) Ground Water Levels**

The most recent period for which water-level contour maps are available for the Madera W.D. area is Spring 1993 (Figure 5). At that time, ground water elevation appears to have averaged about 150 feet above m.s.l. By inspection of pumping records it appears water levels in the District have continued to decline in the intervening years since the 1993 map was prepared.

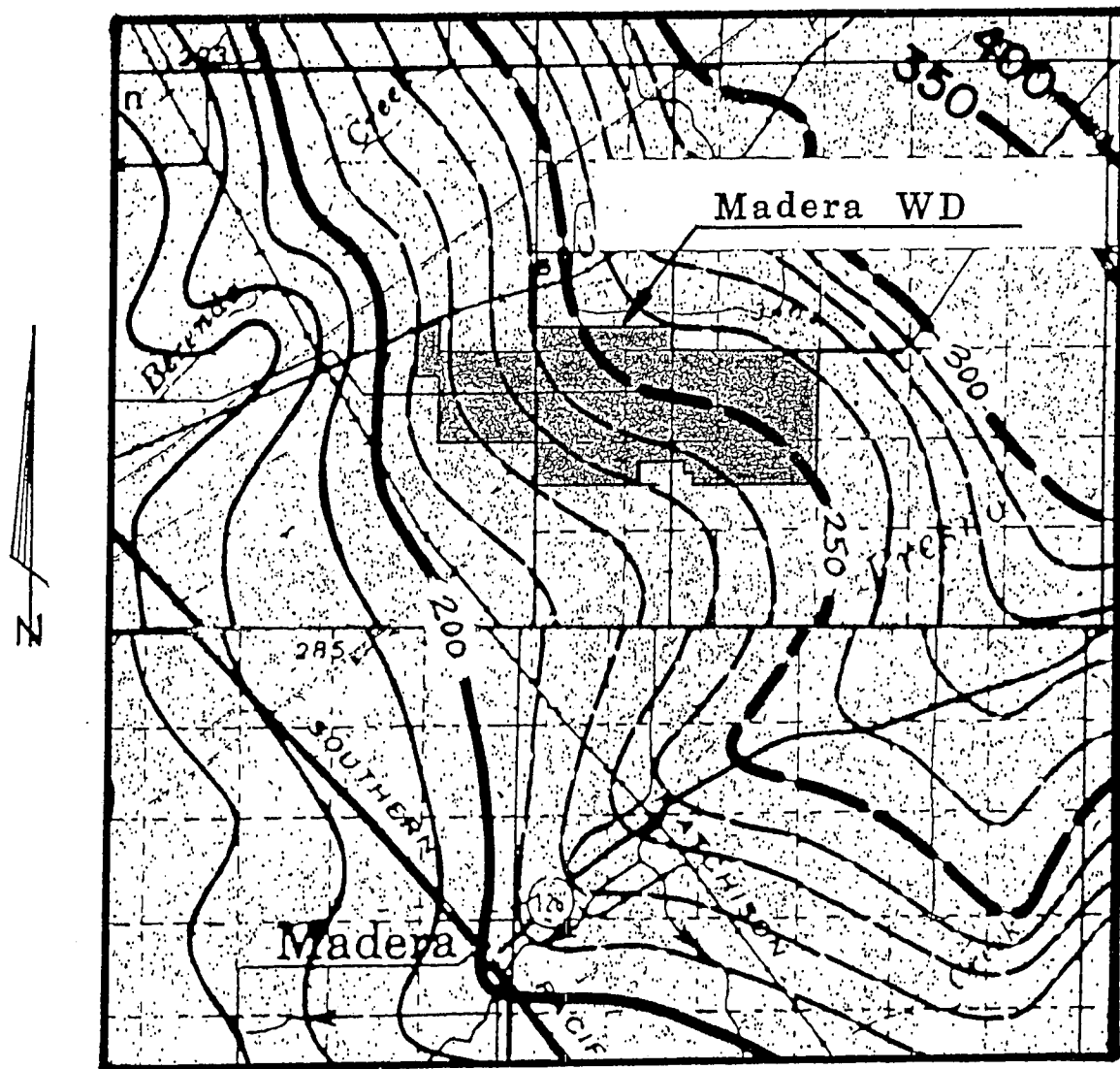


MADERA WATER DISTRICT  
GROUND WATER MANAGEMENT PLAN

FIGURE 3

LINES OF EQUAL ELEVATION OF  
GROUND WATER TABLE  
FALL OF 1936

Ref: California DWR



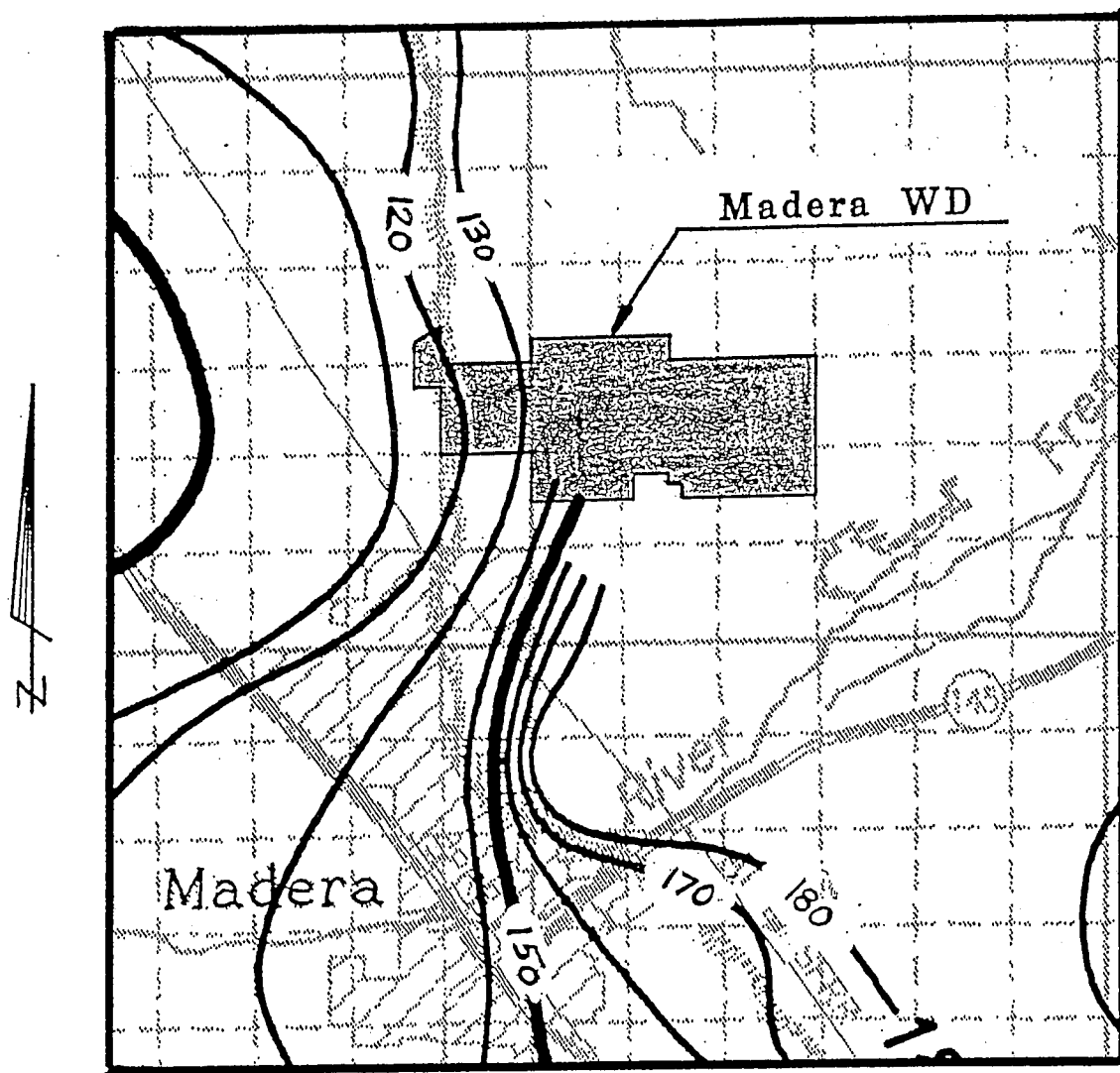
MADERA WATER DISTRICT  
GROUND WATER MANAGEMENT PLAN

FIGURE 4

LINES OF EQUAL ELEVATION OF  
WATER IN WELLS  
UNCONFINED AQUIFER, SPRING 1965

Ref: California DWR





MADERA WATER DISTRICT  
GROUND WATER MANAGEMENT PLAN

FIGURE 5

LINES OF EQUAL ELEVATION OF  
WATER IN WELLS  
UNCONFINED AQUIFER, SPRING 1993

Ref: California DWR

**Estimated Pump Lift** - Pumping lifts within the Madera W.D. for production irrigation wells range from around 250 to nearly 400 feet. Typical lifts are around 300 feet.

2) **Ground Water Quality**

Ground water pumped from the unconfined aquifer remains adequate for agricultural use.

C. **Ground Water Overdraft**

Sufficient data are not currently available to quantify ground water overdraft within the District. The long-term decline of water levels does indicate the area is experiencing an overdraft condition.

D. **Extraction and Perennial Yield**

Ground water pumping by the District is measured, and has averaged 6,840 af over the last two years. This amount has decreased recently due to the newly developed ability to divert additional surface water from the Dry Creek Canal. Prior to 1996, a larger share of the demand of the District was met with ground water pumping, and extractions averaged around 7,870 af per year.

Perennial, or sustained, yield is defined here as the average annual amount of ground water pumping that can be supported over an average hydrologic base period that will not result in a long-term decline in water levels. The base period must be long enough to include both wet and dry hydrologic cycles.

Perennial yield is currently impossible to quantify for Madera W.D. due to a lack of sufficient data and the shared nature of the aquifer. Madera W.D. is not a "closed" ground water system. That is, ground water in the District is hydraulically connected to ground water in the surrounding area. Substantial changes in ground water levels within or in the vicinity of the District could affect the perennial yield of the District's ground water supply. Under current conditions ground water flow across the District is fairly uniform and it appears subsurface inflow roughly balances subsurface outflow.

The long-term decline in ground water levels in the District indicates the perennial yield for the District is currently being exceeded.

**E. Ground Water Monitoring**

Madera W.D. does not currently monitor ground water levels or quality. The DWR does measure water levels in some wells in the vicinity of the District. These measurements are taken each spring and fall as a part of the State's San Joaquin Valley-wide ground water monitoring program.

## V. MANAGEMENT PLAN ELEMENTS

### A. Control of Saline Water Intrusion

Saline water intrusion is not currently a concern for Madera W.D. While the ground water may tend to be more saline in deeper portions of the regional aquifer, this appears to be a natural condition inherent in the geology, and does not threaten the District's ground water supply.

### B. Identification and Management of Wellhead Protection Areas and Recharge Areas

The Federal Wellhead Protection Program was established by Section 1428 of the Safe Drinking Water Act Amendments of 1986. The purpose of the program is to protect ground water sources of public drinking water supplies from contamination, thereby eliminating the need for costly treatment to meet drinking water standards. The program is based on the concept that the development and application of land use controls, usually applied at the local level in California, and other preventative measures can protect ground water.

A Wellhead Protection Area (WHPA), as defined by the 1986 Amendments, is "the surface and subsurface area surrounding a water well or wellfield supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or wellfield." The WHPA may also be the recharge area that provides the water to a well or wellfield. Unlike surface watersheds that can be easily determined from topography, WHPA's can vary in size and shape depending on subsurface geologic conditions, the direction of ground water flow, pumping rates and aquifer characteristics. There are several different methods typically used to delineate the lateral boundaries of a WHPA.

Under the Act, states are required to develop an EPA-approved Wellhead Protection Program. To date, California has no state-mandated program, but instead relies on local agencies to plan and implement programs. This is one of the factors that prompted the State Legislature to enact AB 3030. Wellhead Protection Programs are not regulatory in nature, nor do they address specific sources. They are designed to focus on the management of the resource rather than control a limited set of activities or contaminant sources.

As Madera W.D. does not provide public drinking water, Wellhead Protection Areas are not currently applicable to this plan.

**C. Regulation of the Migration of Contaminated Ground Water**

Ground water contamination can originate from many sources or activities. Clean-up of contaminated ground water is a complex and expensive task generally involving a number of organizations. Agencies with roles to play in mitigating ground water contamination include the California Regional Water Quality Control Board (RWQCB), the California Department of Toxic Substances Control (DTSC) and the U.S. Environmental Protection Agency (EPA). Each agency has its own set of regulatory authorities and expertise to contribute, and the degree to which they participate depends on the nature and magnitude of the problem. The role of the Madera W.D. will be to report any contamination that they may discover to the appropriate agency.

**D. Administration of a Well Abandonment and Well Destruction Program**

Existing State and Madera County law requires that owners or lessees properly destroy their abandoned wells. Proper destruction of abandoned wells is necessary to protect ground water resources since abandoned or improperly destroyed wells can result in water of different chemical qualities from different strata mixing, and useable ground water being degraded. The responsibility for administration and enforcement of the County well ordinance will be left with Madera County.

**E. Mitigation of Conditions of Overdraft**

Overdraft of the ground water supply can lead to a variety of problems, including land subsidence and increased pumping costs. Additionally, if overdraft continues unchecked, the ground water supply may become unreliable when surface water is scarce, as in a time of extended drought.

Ground water overdraft is due to an imbalance in the rates of extractions and replenishment. There are several methods to correct this imbalance. The first is to decrease the extraction to match the rate of replenishment. The second is to increase ground water replenishment to match the extraction rate. A third method is a combination of the first two, to balance replenishment and extraction. Each of the methods are applied over an extended period, making use of the storage capacity of the aquifer. Extractions can exceed replenishment in drought periods as long as replenishment equally exceeds extractions in wetter periods.

Overdraft within the District is not currently quantifiable due to insufficient available data. The fact that the Madera ground water basin is defined as being in a condition of critical overdraft, in conjunction with the observed long-term

decline in well water levels within the Madera W.D., indicates that the District probably is overdrafting the ground water aquifer. Factors that will affect the future rate of overdraft include:

- 1) Future water demand in the District.
- 2) Future pumping outside the District. Continued decline of water levels to the west of Madera W.D. could increase the subsurface outflow of ground water.

Overdraft is a significant concern in the District, and if it continues unchecked it could ultimately affect the reliability and even availability of the District's water supply. Periodic analyses of the District's ground water levels are needed to quantify the overdraft situation.

Possible mitigative measures include reducing ground water pumping by reducing District water demand and increasing ground water recharge. Local streamflow and San Joaquin River flood waters are potential sources of recharge water.

#### **F. Replenishment of Ground Water Extracted by Water Producers**

Replenishment of ground water is an important technique in management of a ground water supply and mitigate a condition of overdraft. Direct recharge of ground water is problematical within the District due to its condition of complete agricultural development.

#### **G. Monitoring of Ground Water Levels and Storage**

The purpose of a ground water level monitoring program is to provide information that will allow computation of the change in ground water storage. Madera W.D. will initiate a program of measuring well water levels in the spring and fall, in cooperation with the USBR and DWR. Contour maps depicting level of water in wells in the District and surrounding area will be prepared on an annual basis, along with estimates of changes in ground water storage.

## H. Facilitating Conjunctive Use Operations

Conjunctive operation of a ground water basin is defined in DWR Bulletin 118-80 as:

"Operation of a ground water basin in coordination with a surface water reservoir system. The basin is intentionally recharged in years of above average precipitation so ground water can be extracted in years of below average precipitation when surface water supplies are below normal."

Such management results in the ground water storage being reduced in dry periods and increased in wetter periods. To avoid a condition of overdraft, replenishment and subsurface inflow must balance extraction and groundwater outflow over the long-term.

A conjunctive use program generally requires:

- A source of surface water in years of plentiful surface water supply.
- Recharge facilities.
- Conveyance facilities to import and export water to and from the ground water storage area.
- Available storage capacity in the aquifer.
- Extraction facilities.
- Distribution facilities for surface and ground water.

Madera Water District will not be able to develop all aspects of a complete conjunctive use program within the District. An increased emphasis on the use of surface water available from the Dry Creek Canal, however, can implement some components of conjunctive use.

## I. Identification of Well Construction Policies

Improperly constructed wells may result in contaminated ground water by establishing a pathway for pollutants entering a well through drainage from the surface, allowing mixing between aquifers of varying water quality, or the unauthorized disposal of waste into the well. Madera County has enacted and is responsible for enforcing an County Well Ordinance that regulates well construction.

**J. Construction and Operation of Ground Water Management Facilities**

Effectively managing a ground water supply requires facilities that protect the quality and assure that the quantity of ground water in storage is sufficient to meet long-term operational goals. Given the complete agricultural development of the Madera W.D., the potential for ground water recharge facilities is extremely limited. The ability to take surface water from the Dry Creek Canal in-lieu of pumping ground water however can equivalently place additional water in the ground.

**K. Development of Relationships with Federal, State and Local Regulatory Agencies**

The development of relationships between the ground water management district and the various regulatory agencies is an important part of an effective ground water management plan. This plan will be submitted to DWR, and Madera W.D. will work with DWR and USBR to monitor and report ground water conditions within the District. Ground water management activities will be coordinated with surrounding Madera Basin ground water management agencies including the Madera Irrigation District. As ground water management intensifies in the region, Madera W.D. may pursue development and execution of "Memorandums of Understanding" (MOU's) with the County of Madera and the Madera I.D.

**L. Review of Land Use Plans and Coordination with Land Use Planning Agencies**

An important component of developing a ground water management plan is the review of land use plans for the surrounding area or basin, and coordinating efforts with regional and local land use planning agencies. Land use planning activities in unincorporated areas of Madera County are performed by the County of Madera's Planning Department, and overseen by the Madera County Planning Commission. Madera W.D. does not have land use planning authority, therefore regional and local land use planning activities will remain with the appropriate agencies.



## **VI. GROUND WATER MANAGEMENT PROGRAM**

### **A. Program Components**

This Program requires the implementation of the following Plan Elements, as defined in the previous section:

- 1) Monitoring and analysis of ground water levels.
- 2) Development of relationships with regulatory agencies, neighboring agencies with ground water management authority, and the County of Madera.
- 3) Continued efforts to maximize the use of surface water in-lieu of ground water pumping.

### **B. Program Costs, Funding and Potential Fees**

Initial costs to implement the program will be borne by Madera W.D. If additional funds are necessary to implement the Program and are outside the current authority of the Madera W.D. to raise, but within the powers granted by AB 3030, a public vote will be required. A simple majority is necessary to approve a measure to levee a fee for ground water management.

### **C. Implementation Schedule**

Upon adoption of the Ground Water Management Plan, the Program will be implemented on the following schedule:

- 1) Initiate a ground water monitoring program within one year.
- 2) Begin developing relationships with other agencies within one year.
- 3) Efforts to maximize use of surface water are on-going.

APPENDIX A

Madera W.D. Resolution No. 97-1

Resolution of Intention of Madera Water District  
to Draft a Ground Water Management Plan